Long-term Acoustic Real-Time Sensor for Polar Areas (LARA)

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LONG-TERM GOALS

The long-term goal of this project is to develop the Long-term Acoustic Real-Time Sensor for Polar Areas (LARA) for real-time monitoring of marine mammals, ambient noise levels, seismic activities (e.g., eruption of undersea volcanoes), and oceanographic conditions in the upper 300 m of the water column.

OBJECTIVES

Most state-of-the-art autonomous passive acoustic monitoring packages are designed to be moored in deep water and stay submerged for the entire deployment period (for a summary see Mellinger *et al.*, 2007). Accordingly deep-moored instruments are usually archival instruments, for which it is not possible to access data, gain timely information on the presence of acoustic signals of interest (such as marine mammal vocalizations or seismic events), or identify system malfunctions prior to instrument recovery. A few passive acoustic monitoring systems use a surface buoy to overcome some of these disadvantages, but these systems cannot be reliably operated in polar areas with potential ice coverage. The Long-term Acoustic Real-Time Sensor for Polar Areas (LARA; Fig. 1) combines the advantages of both the submerged and surface systems and and can be operated in ice-covered areas.

APPROACH

LARA will be deployed on a typical oceanographic mooring (Fig. 1) at a predefined depth (~300 m) to record acoustic signals and detect events of interest for up to one year. LARA's control module will run an ice sensing algorithm (ISA) based on the temperature profile in the upper 300 m of the water column. This algorithm has been proven to reliably detect sea ice in the Antarctic Ocean (Klatt *et al.*, 2007) and is currently being tested in the Arctic (Olaf Boebel, pers. comm.). LARA's acoustic module operates an on-board acoustic event detector in real-time (e.g., Klinck and Mellinger, 2011). After an event is detected, a command is sent to the winch via hydro-acoustic modem to raise the sensor to about 10 m depth. During this process the control module is monitoring depth and water temperature. Based on these measurements, the control module decides whether or not to surface the sensor. In case the "no sea ice criterion" is fulfilled, the control module sends a command to the winch to surface LARA. To further reduce the risk of damage by ice and other surface activities only the antenna will

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be raised to the surface (see Fig. 1); the actual sensor unit (containing the archived data) stays about 5 m submerged (note: Kwok and Rothrock (2009) reported a mean Arctic sea ice thickness of 1.89 m for 2008). Several of the components of this sensor (e.g., underwater winch, passive acoustic module, marine mammal detection and ice sensing algorithms) are already developed and proven technology and are being used successfully in other ONR-funded glider and float projects; it is the combination of these components and the real-time transmission of the data that make the platform unique.
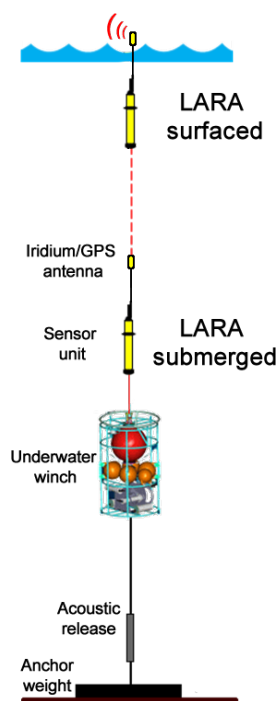

Fig. 1: Schematic of the proposed LARA

WORK COMPLETED

Because of delays associated with the sequester, the project officially started in July 2013. To date we have mainly prepared and forwarded purchase orders to start building the equipment.

The construction of the underwater winch (Fig. 2) has already been completed by NiGK Corporation, Japan and the instrument will be shipped to the U.S. by end of September 2013. We have also started developing LARA's main controller board and are currently bench testing revision 1.0 of the board.

Fig. 2: Underwater winch.

RESULTS

Because the project started just 3 months before the due date of this annual report, there are no significant results to report for the FY13 period.

IMPACT/APPLICATIONS

LARA will expand our capability of long-term passive-acoustic real-time monitoring and more importantely allow us to conduct research in ice-covered regions such as the Arctic, a high priority area of DoD. LARA will also function as a test and development platform for new and improved detection algorithms which will potentially be implemented and used on acoustically equipped gliders and floats as well as the Marine Mammal Monitoring on Navy Ranges (M3R) systems at AUTEC and SCORE. In addition LARA technology will be useful for real-time monitoring of deep-ocean seismic and volcanic activity (e.g., Dziak *et al.*, 2011) - especially in areas where SOSUS coverage no longer exists. For example, the LARA system is intended be used to monitor continued and impending magmatic activity at Axial Volcano and the Middle Valley Ridge segment in the northeast Pacific Ocean. Both areas have seafloor volcanic eruptions forecast for the near future, and the LARA moorings will allow us to observe the accuracy of these models in real-time.

TRANSITIONS

Not applicable.

RELATED PROJECTS

None.

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PUBLICATIONS

None.

PATENTS

None.

HONORS/AWARDS/PRIZES

None.